DOE–LM/GJ1197–2006

Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites

U.S. Department of Energy

Office of Legacy Management

Work Performed Under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management.
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Sampling and Analysis Plan
for
U.S. Department of Energy Office of Legacy Management Sites

Work Performed by S.M. Stoller Corporation under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado

Summary of Changes

Section 3.1.1.2 and Section 3.1.2 were updated to include additional information on sample filtration.

A Job Safety Analysis regarding routine sampling activities was inserted into Appendix C.

Appendix D was updated to include sampling information for the Nevada Offsites. The sampling frequency and analyte lists were updated for each site. Program directives were added for 2008.

End of current text

Summary of Changes

Section 2.0 was changed from "Access" to "Pre-Trip Planning" to include meeting with the appropriate manager prior to a sampling event in response to a management assessment.

The LM-wide JSA was added as an appendix to address 10 CFR 851 requirements. Appendix references changed throughout the document.

The requirement to remove one pump/tubing volume prior to making water quality measurements was added to reflect a process improvement.

The option to navigate to a surface water location with a GPS unit in lieu of a marked post was added to reflect a process improvement.

Changes were made to Section 6.0, "Health and Safety," to reflect the new safety program under 10 CFR 851.

A log of current Program Directives was added to Appendix D.

Program Directives for Fernald and Moab were added to address site-specific requirements.

End of current text

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Approval Signature:

signature on original

Sam Campbell, Manager Environmental Monitoring/Field Services

Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
BOA	Basic Ordering Agreement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
Ft	foot or feet
ICPT	Integrated Contractor Purchasing Team
LM	Office of Legacy Management
mg/L	milligram(s) per liter
mL	milliliter(s)
mL/min	milliliter(s) per minute
NTU	nephelometric turbidity units
NIST	National Institute of Standards and Technology
PCB	polychlorinated biphenyls
pCi/L	picocuries per liter
QA	quality assurance
QC	quality control
QSAS	Quality Systems for Analytical Services
SOP	standard operating procedures
TLD	thermoluminescent dosimeter
VOC	volatile organic compound

End of current text

1.0 Introduction

This plan incorporates U.S. Department of Energy (DOE) Office of Legacy Management (LM) standard operating procedures (SOPs) into environmental monitoring activities and will be implemented at all sites managed by DOE−LM, except the Pinellas Environmental Restoration Project, which has its own plan that specifies state of Florida requirements. This document provides detailed procedures to the field sampling teams so that samples are collected in a consistent and technically defensible manner. Site-specific planning documents (e.g., long-term surveillance and maintenance plans, environmental monitoring plans) document background information and establish the basis for sampling and monitoring activities. Information will be included in site-specific tabbed sections to this plan that identifies sample locations, sample frequencies, types of samples, field measurements, and associated analytes for each site. Additionally within the tabbed section, Program Directives will be included, when developed, to establish additional site-specific requirements to modify or add clarification to requirements in this plan as they apply to the site. A flowchart detailing project tasks required to accomplish routine sampling is displayed on Figure 1–1.

LM SOPs are contained in the *Environmental Procedures Catalog* (STO 6), which incorporates American Society for Testing and Materials (ASTM), DOE, and U.S. Environmental Protection Agency (EPA) guidance. Specific SOPs used for ground water and surface water monitoring are included in Appendix A. Some SOPs have been revised in this plan to reflect current industry practices. If monitoring of other environmental media is required, SOPs used for air, soil/sediment, and biota monitoring can be found behind the site–specific tabbed section in Appendix D.

The procedures in the *Environmental Procedures Catalog* (STO 6) are intended as general guidance and require additional detail from project planning documents in order to be complete; the following sections fulfill that function and specify additional procedural requirements. If a discrepancy exists between a SOP (STO 6) and an instruction in this plan, then the instruction in this plan takes precedence over the procedure.

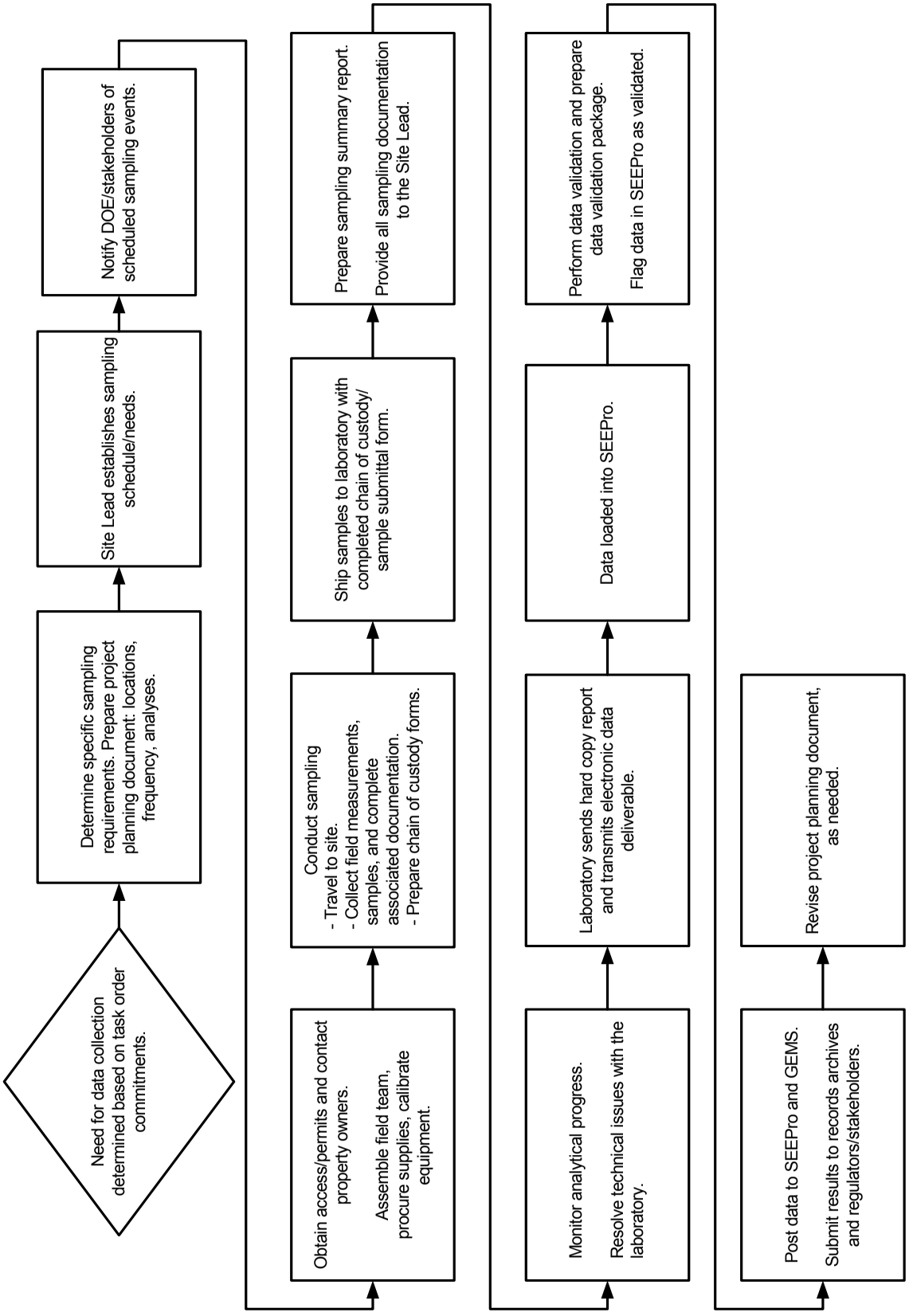

Figure 1–1. Sampling Flowchart

2.0 Pre-Trip Planning

Sampling personnel will meet with the Site Lead or appropriate manager prior to each sampling event. The purpose of the meeting is to:

- Discuss any new site issues involving safety, access to locations, or land owner concerns.
- Identify tasks that can be completed by the sampling team while at the site, which may include well maintenance, collection of global positioning satellite data, downloading of data loggers, and pump repair or replacement, sign replacement, fence repair, and telemetry support.
- Capture changes to sampling locations and/or required analyses.

The Site Lead is responsible for ensuring that valid access agreements are in place and landowner notifications are made prior to a sampling event. The Real and Personal Property group will assist the Site Lead by managing the access agreement process, including drafting access agreements, obtaining the required approvals, tracking expiration dates, and processing renewals. The Real and Personal Property group also will notify landowners of the upcoming sampling event. Any property damage that occurs as a result of the sampling event must be reported immediately to the Site Lead.

End of current text

3.0 Sampling Protocol

3.1 Water

3.1.1 Ground Water

3.1.1.1 Well Classification

Ground water sampling protocol will vary based on the classification of the well. Wells will be classified according to their hydraulic properties or use as follows:

Classification	Properties/Use
Category I	Wells that produce a minimum of 100 milliliters per minute (mL/min).
Category II	Wells that produce less than 100 mL/min and have an initial water level above the top of the screened interval.
Category III	Wells that produce less than 100 mL/min and have an initial water level within the screened interval.
Category IV	Domestic and flowing wells.

Category I Protocol

Purging and sampling of Category I wells will be accomplished using a low-flow method that involves pumping at a low-flow rate. In theory, the slow pumping rate will allow water to flow directly from the formation to the pump intake. The slow pumping rate will result in minimal mixing with the stagnant water column above the pump intake, minimal pumping-induced turbidity, and minimal disturbance of sediment accumulated in the end cap of the well. Using the Category I sampling protocol will provide the highest quality sample (Korte 2001).

Category I wells will be purged using the following guidelines:

- The intake of the portable pump, dedicated pump, or dedicated tubing should be placed in the approximate middle of the screened interval.
- If a portable pump is used, a minimum of 4 hours after installation is required before purging and sampling can commence.

As described in procedure LQ−2 (T), "Standard Test Method for the Measurement of Water Levels in Ground Water Monitoring Wells" (STO 6), depth to water will be measured with an electric sounder immediately prior to purging. The initial pumping rate should not exceed 500 milliliters per minute (mL/min). At the start of pumping, the water level should be monitored continuously to determine if drawdown is occurring. If drawdown is occurring at the initial pumping rate, the pump rate should be decreased until the drawdown stops or a pump rate of 100 mL/min is obtained. If the water level stabilizes (essentially no drawdown), then purging and sampling may continue at that flow rate. Water levels in the well will be measured and recorded at regular intervals (minimum of 3 minutes apart) on the Water Sampling Field Data Sheet during the purging process to document that drawdown was not occurring during the purge. If the water level does not stabilize at the minimum flow rate of 100 mL/min, then the well will be classified as a Category II or Category III well.

After one pump/tubing volume has been purged, pH, specific conductance, and turbidity will be measured at regular intervals based on volume purged or time, with measurements recorded a minimum of 3 minutes apart. Sample collection will begin as soon as pH, specific conductance, and turbidity measurements stabilize and one pump/tubing volume has been removed. Specific conductance and pH will be considered stable when the three most current consecutive readings are within 10 percent and 0.2 pH unit, respectively; turbidity measurements will be considered stable when the most current reading is less than 10 nephelometric turbidity units (NTU). Criteria for purging a Category I well are summarized in Table 3−1.

Table 3–1. Summary of Ground Water Sampling Protocol

Well Classification	Parameter	Purge Criteria	Qualification
Category I	Purge volume	1 pump/tubing volume	No qualification of results required
	Flow rate	>100 mL/min and <500 mL/min	
	Water level	<0.05 ft drop[a]	
	PH	± 0.2 pH units[a]	
	Specific conductance	± 10 percent[a]	
	Turbidity	< 10 NTUs	
Category II	Purge volume	1 pump/tubing volume	Qualify results (see Section 7.2)
	Flow rate	<500 mL/min	
	Water level	None	
	PH	None	
	Specific conductance	None	
	Turbidity	None	
Category III	All parameters	No purge required	Qualify results (see Section 7.2)
Category IV	All parameters	No purge required	No qualification of results required

[a]Criterion is for the three most current consecutive readings.

Purge water will be disposed of according to site-specific or program-specific documents, which may include one or more of the following: *Technical Approach for the Management of UMTRA Ground Water Investigation-Derived Wastes* (DOE 1994); *Management Plan for Field-Generated Investigation Derived Waste* (DOE 1997); *Site Generated Waste Management for the Weldon Spring Site* (Morrison Knudsen Corporation 2001); *Monticello Mill Tailings Site Operable Unit III Post-Record of Decision Monitoring Plan* (DOE 2004); or Program Directives included in this plan.

Category II Protocol

The following protocol will apply to wells that are classified as Category II. A maximum flow rate of 500 mL/min will be used to purge and sample wells in this category. There are no stabilization or drawdown criteria for Category II wells. Sampling can occur as soon as one pump/tubing volume is removed. Recording of water levels and flow rates will be used to initially document that the well is a Category II well using the criteria stated in Sections 3.1.1.1 and 3.1.1.2. Criteria for purging a Category II well are summarized in Table 3−1.

Category III Protocol

The following protocol will apply to wells that are classified as Category III. There are no stabilization, drawdown, or purge volume criteria for Category III wells. If a bailer is used to sample, it must be lowered very slowly into the water column in order to minimize sampling-related turbidity. Only the first bailer of water will be used for the sample. Subsequent bailers introduced into the water column increase turbidity and reduce sample quality. Because the volume of water will be limited using a bailer, prioritization of analytes will be required. This will require an estimation of sample volume prior to the sampling event. The volume estimate will be discussed with the Site Lead and the analytical laboratory to determine which constituents will be analyzed. If a sufficient volume of water cannot be obtained from the first bailer, then the well cannot be sampled. If there is a sufficient column of water in the well to utilize a dedicated pump or dedicated tubing, then the entire water volume available can be sampled. Recording of water levels and flow rates will be used to initially document that the well is a Category III well using the criteria stated in Sections 3.1.1.1 and 3.1.1.2.

Because obtaining a representative sample from a low-producing well (Category II and Category III) is problematic (Korte 2001), and there is not adequate guidance for sampling wells completed in low permeability formations (EPA 1995), there may be site-specific documents that require an alternate method for sampling low-producing wells. This may include purging a well dry and sampling when sufficient recovery has occurred, purging without dewatering the screen, or passive diffusive sampling.

Category IV Protocol

With domestic and flowing wells, it is assumed that formation water continually flows from the well, eliminating stagnant water and the need to purge. These wells will be sampled by filling bottles at the discharge point and filtering if required.

3.1.1.2 Sample Collection

Ground water samples can be collected with a peristaltic pump, bladder pump, submersible pump, or a bailer. The specific method used for withdrawing water from the well will be determined in the field on the basis of site-specific conditions and the category of the well. Sample collection will be conducted using the same flow rate used during the purging of the well. Generally, sampling will be conducted proceeding from the least to most contaminated areas of the site, as access allows, unless dedicated pumps or dedicated down-hole tubing are used.

Samples collected for metals, cations, anions, inorganic, and radiological analyses will be filtered if sample turbidity is greater than or equal to 10 NTUs; no sample filtration is required if turbidity is less than 10 NTUs. Alternate sample filtration protocol may be specified in a site specific planning document or Program Directive. Samples requiring filtration will use a 0.45-micron filter, and samples requiring cooling will be stored in a cooler with ice immediately after sample collection. For samples preserved with acid or sodium hydroxide, the pH will be checked (with pH paper) on selected samples to establish the volume of preservative required and to verify the proper pH level has been obtained. Only commercially supplied and certified solutions will be used for sample preservation. Sample container and preservation requirements are shown in Table 3–2.

Table 3–2. Water Sample Collection Requirements

Analytical Parameter	Container Type[b]/Size	Preservation	Holding Time
Metals and Cations (Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Hg, Pb, Li, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, Tl, Sn, U, V, Zn)	Amber HDPE/500 mL	Filtered[c](0.45 µm), HNO_3 pH<2	6 months
Tc-99	HDPE/1L	Filtered[c](0.45 µm), HNO_3 pH<2	6 months
Am-241	HDPE/500 mL[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Ra-226, Ra-228	HDPE/2 @ 1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Th-230	HDPE/1L	Filtered[c](0.45 µm), HNO_3 pH<2	6 months
U-234, U-238	HDPE/1L	Filtered[c](0.45 µm), HNO_3 pH<2	6 months
Pb-210, Po-210	HDPE/1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Gross α, Gross β	HDPE/1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Gamma Spectrometry	HDPE/1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Ne-237, Pu-238, Pu-239, Pu-240	HDPE/1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Ni-63	HDPE/1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Tritium	HDPE/1L[d]	No preservative	6 months
Anions (Br, Cl, F, SO_4, SiO_2)	HDPE/125 mL	Filtered[c] (0.45 µm), Cool 0–4˚ C	28 days
Chemical oxygen demand	HDPE/125 mL	H_2SO_4 pH<2, Cool 0 °C to 4 °C	28 days
Nitrate plus nitrite as N, Ammonia as N, Phosphate	HDPE/125 mL	Filtered[c] (0.45 µm), H_2SO_4 pH<2, Cool 0 °C to 4 ˚C	28 days
Nitroaromatics	Amber glass/1L[e]	Cool 0 °C to 4 ˚C	7 days
Total dissolved solids	HDPE/125 mL	Filtered[c] (0.45 µm), Cool 0 °C to 4 ˚C	7 days
Total organic carbon	HDPE/125 mL	H_2SO_4 pH<2, Cool 0 °C to 4 ˚C	28 days
Total suspended solids	HDPE/1 L	Cool 0 °C to 4 ˚C	7 days
Sulfide	HDPE/1L[d]	Filtered[c] (0.45 µm), NaOH pH >9, 2 mL of 2 N zinc acetate, Cool 0 °C to 4 ˚C, no headspace	7 days
Cyanide	HDPE/1L	Filtered[c] (0.45 µm), NaOH pH > 12, 0.6 g ascorbic acid if Cl_2 present, Cool 0 °C to 4 ˚C	14 days
Polynuclear aromatic hydrocarbons	Glass/3 @ 40 mL	Cool 0 °C to 4 ˚C, HCl pH<2, 0.008 % $Na_2S_2O_3$, no headspace	14 days
PCBs	Amber glass/1L[e]	Cool 0 °C to 4 ˚C	7 days
TPH	Amber glass/1L[e]	Cool 0 °C to 4 ˚C	14 days
VOCs/BTEX	Amber glass/3 @ 40 mL	Cool 0 °C to 4 ˚C, HCl pH<2, no headspace	14 days
SemiVOCs	Amber glass/1L[e]	Cool 0 °C to 4 ˚C	7 days
Rn-222	Glass/3 @ 40 mL	Cool 0 °C to 4 ˚C, no headspace	Not Established

[a]This table incorporates the majority of analyses conducted for LM projects; consult the site-specific environmental planning document for the analyses required at a particular site.
[b]HDPE=high density polyethylene. Amber is required only if light sensitive analysis [e.g., for silver (Ag] is conducted.
[c]Filtration of samples may not be required on all samples and/or all projects; collection of unfiltered samples will be specified in other project planning documents.
[d]Collection of sample volume in duplicate for every 20 samples collected is required for laboratory quality control.
[e]Collection of sample volume in triplicate for every 20 samples collected is required for laboratory quality control.

3.1.2 Surface Water

For purposes of this plan, surface water may include contained water within any natural or man made surface water feature (e.g., ponds, lakes, seeps, rivers, ditches, drainages), as well as effluent from passive treatment systems, leachate collection systems, or water treatment plants.

Surface water sampling will be conducted according to the following protocol unless an alternate protocol is specified in a project planning document, permit, or in the appropriate site–specific tabbed section in Appendix D. Specifically, surface water grab samples will be collected as follows:

- Surface water samples will be collected using a stainless steel weight attached to the intake tubing of the peristaltic pump. The stainless steel weight has an intake port approximately 2 inches above the base of the weight, which will allow the sample to be collected near the bottom of the surface water feature.
- For surface water features less than 6 feet (ft) wide, the sample will be collected from approximately the middle.
- For surface water features greater than 6 ft wide, the sample will be collected 1 to 3 ft from the shore. Samples collected in flowing surface water features greater than 6 ft wide (e.g., rivers, streams, ditches) will be collected within the main current and not in stagnant or back eddy areas.
- If stagnant or back eddy areas extend greater than 3 ft from the shore, then the sample will be collected at the nearest downstream location where the main current is within 3 ft of the shore. This approach can be modified to meet special data quality objectives, such as sampling fish habitats, and will be specified in a project-planning document.
- All surface locations will be designated by a wooden lath or metal post inscribed with the location identification so that samples from subsequent rounds may be collected from approximately the same location, or navigation to the location can be accomplished using a global-positioning satellite device.
- Sample location data should be collected using a global positioning satellite device and downloaded into SEEPro database. Any departure from collecting a sample at the normal location must be documented on the Water Sampling Field Data form.

Samples collected for metals, cations, anions, inorganic, and radiological analyses will be filtered if sample turbidity is greater than or equal to 10 NTUs; no sample filtration is required if turbidity is less than 10 NTUs. Alternate sample filtration protocol may be specified in a site specific planning document or Program Directive. Samples requiring filtration will use a 0.45-micron filter, and samples requiring cooling will be stored in a cooler with ice immediately after sample collection. For samples preserved with acid or sodium hydroxide, the pH will be checked (with pH paper) on selected samples to establish the volume of preservative required and to verify the proper pH level has been obtained. Only commercially supplied and certified solutions will be used for sample preservation. Sample container and preservation requirements are shown in Table 3–2.

If unfiltered surface water samples are collected, the sample may be collected by container immersion as described in procedure LQ-11(P), “Standard Practice for the Sampling of Liquids” (STO 6), Appendix A.

3.1.3 Field Measurements and Calibration

Field measurements of alkalinity, dissolved oxygen, oxidation-reduction potential, and temperature may be required on a site-specific basis. Specific conductance, pH, and turbidity are considered stabilization parameters when purging a well and are required measurements at all wells. General procedures for field measurements are in Appendix A. Calibration of field instrumentation will be conducted according to manufacturer's recommendations. Calibration and operational check requirements for field instrumentation are shown in Table 3−3. If the acceptance criteria are not met during the operational check, then a primary calibration of the affected probe(s) and instrument(s) must be conducted. Probe replacement or cleaning also may be required if the operational acceptance criteria are not met.

Table 3–3. Calibration and Operational Check Requirements for Field Instrumentation

Parameter	Requirement	Frequency	Operational Check Criteria
pH	3-point calibration	Prior to start of sampling event	NA[a]
	1-point check with pH 4, 7, or 10 buffer	Twice daily	± 0.2 pH unit
Specific conductance	1-point calibration	Prior to start of sampling event	NA
	1-point operational check	Twice daily	± 10 percent of standard
Oxidation-reduction potential	1-point calibration	Prior to start of sampling event	NA
	1-point operational check	Twice daily	± 10 percent of standard
Dissolved Oxygen	Calibration in water saturated air	Twice daily	NA
Turbidity	4-point calibration	Every 6 months	NA
	3-point operational check	Twice daily	± 10 percent of standard
Temperature	Operational check	Prior to start of sampling event	± 1.5 ºC compared to NIST[b] traceable thermometer

[a]NA = Not applicable.
[b]NIST = National Institute of Standards and Technology.

3.1.4 Sample Identification and Handling Procedures

Each sample will be assigned a unique sample number and a site identification number corresponding to each well or surface sample location. Quality control (QC) samples will be assigned a fictitious site identification number and submitted to the laboratory without identifying them as QC samples. The true site identification number and the type of QC sample will be documented on the QC Sample Cross-Reference Log.

Immediately upon collection, samples requiring refrigeration will be placed in ice chests containing an ice and water bath. An ice and water bath will be maintained within the ice chests at all times and will be checked and documented on the Water Sampling Field Data form after each location is sampled.

Sample bottles used for water sampling will be pre-cleaned to guidelines established by EPA in *Specification and Guidance for Contaminant-Free Sample Containers* (EPA 1992).

To ensure the integrity of the sample, the Sampling Lead, or designee, is responsible for the care, packaging, and custody of the samples until they are dispatched to the laboratory. Procedure GT-3(P), "Standard Practice for Chain-of-Custody Control and Physical Security of Samples" (STO 6), will be implemented to provide security and document sample custody, and procedure GA-9(P), "Standard Practice for Sample Submittal to Contract Analytical Laboratories" (STO 6), will be implemented to transfer samples to the designated laboratory.

Custody seals and/or evidence tape will be placed on each ice chest or storage/shipping container that is not in direct control of a sampling team member (e.g., when temporarily stored in a motel room) to maintain physical security of the samples from time of collection to analysis. Samples locked in the sampling vehicle are considered in direct control of the sampling team. Samples not in direct control of a sampling team member will be stored in a secured (locked) location. Ice chests, cartons, and trays used for temporary sample storage that are not custody sealed must be in direct control of a field team member.

If samples are transported by subcontract employees or commercial carrier, the shipping container will have custody seals and/or evidence tape placed over the container opening before shipment to ensure that the integrity of the samples is not compromised during transportation. The Sampling Lead will be responsible for ensuring that the samples are transferred to the laboratory in sufficient time for the laboratory to complete extraction/analysis prior to the expiration of sample holding times.

If a commercial carrier sends the packages, receipts, and any other shipping–related documents are retained as part of the chain-of-custody documentation. The Laboratory Services Coordinator will retain carrier and shipping receipts as long as they have value associated with the laboratory sample receiving activities.

Chain-of-custody records document all transfers of sample possession, and show that the samples were in constant custody between collection and analysis. A Chain-of-Custody form will accompany samples sent or transported to an analytical laboratory by individuals other than a member of the field sampling team, with a copy retained by the originator.

3.1.5 Decontamination of Sampling Equipment

Decontamination of non-dedicated sampling equipment will be accomplished by rinsing all equipment surfaces with diluted detergent followed by deionized water as described in the procedure GT−7(T), "Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites" (STO 6). If non-dedicated sampling equipment is used to collect samples for organic analyses, then an additional rinse with an organic desorbing agent (e.g., isopropanol) will be used followed by a final deionized-water rinse. Decontamination of non-dedicated sampling equipment will be conducted immediately after use at a sampling location. Between samplings or until further use, decontaminated equipment will be stored in protective containers or plastic bags.

3.2 Air

Air monitoring may include sampling air particulates, radon, tritium, gamma radiation, or meteorological monitoring. Air monitoring procedures, if required, will be included in Program Directives located following the appropriate site-specific tabbed section in Appendix D.

3.3 Soil and Sediment

Soil and sediment sampling generally will be conducted according to procedures listed in the solids section of the *Environmental Procedures Catalog* (STO 6). Soil sampling associated with drilling activities will be specified in a statement of work. If site-specific procedures are required, they will be included in Program Directives following the appropriate site-specific tabbed section in Appendix D.

3.4 Ecological

Ecological monitoring may include sampling biota or vegetation, monitoring of vegetation, controlling noxious weeds, or monitoring animal populations. Ecological procedures, if required, will be included in Program Directives located following the appropriate site-specific tabbed section in Appendix D.

4.0 Analytical Program

Analytical services are procured under the DOE Integrated Contractor Purchasing Team (ICPT) Basic Ordering Agreement (BOA) (DOE 2003a) as modified by the *Grand Junction Site Statement of Work for Analytical Laboratory Services* (DOE 2003b). The ICPT BOA provides a standardized system for procuring analytical services from commercial laboratories and includes a Statement of Work for Analytical Services and provisions for laboratory audits.

The constituents analyzed at each site are specified in the site-specific environmental planning document. A comprehensive list of analytes, along with the required analytical methods and required detection limits, are listed in Attachment K of the ICPT BOA (DOE 2003a). The analytical methods used for ground water and surface water analyses as specified in Attachment K are typically from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846) (EPA 1996) or *Methods for Chemical Analysis of Water and Wastes* (EPA 1983). Analytes typically requested for a water matrix, along with required detection limits and analytical methods, are included in Table 4−1.

Commercial laboratories provide these analytical services in accordance with the *DOE Quality Systems for Analytical Services* (QSAS) (DOE 2005b) to ensure data of known, documented quality. The QSAS provides specific technical requirements, clarification of DOE requirements, and conforms to DOE Order 414.1C, *Quality Assurance* (DOE 2005a). The QSAS is based on EPA's National Environmental Laboratory Accreditation Conference, Chapter 5, "Quality Systems" (EPA 2000), and provides a framework for performing, controlling, documenting, and reporting laboratory analyses. Validation of field and analytical data will be accomplished according to the guidance in Appendix B.

Table 4–1. Typical DOE–LM Analyte List with Associated Analytical Specifications for a Water Matrix

Analyte[a]	Required Detection Limit (mg/L)[b]	Analytical Technique[c]	EPA Analytical Method
Al	0.2	ICP-AES	SW-846 6010B
Am-241	0.03	AS	NA
NH_4	0.10	Colorimetric	EPA 350.1
Sb	0.003	ICP-MS	SW-846 6020
As	0.0001	ICP-MS	SW-846 6020
Ba	0.10	ICP-AES	SW-846 6010B
Be	0.008	ICP-AES	SW-846 6010B
Br	0.5	IC	SW-846 9056
Cd	0.001	ICP-MS, ICP-AES	SW-846 6020, SW-846 6010B
Ca	5.0	ICP-AES	SW-846 6010B
COD	5	Colorimetric	EPA 410
Cl	0.5	IC	SW-846 9056
Cr	0.002	ICP-MS	SW-846 6020
Co	0.05	ICP-AES	SW-846 6010B
Cu	0.025	ICP-AES	SW-846 6010B
Cyanide	0.005	Colorimetric	NA
F	0.5	IC	SW-846 9056
Gross Alpha	2.0	PC	SW-846 9310
Gross Beta	4.0	PC	SW-846 9310
Fe	0.05	ICP-AES	SW-846 6010B
Hg	0.001	CVAAS	SW-846 7470
Li	0.1	ICP-AES	SW-846 6010B
Pb	0.002	ICP-MS	SW-846 6020
Pb-210	1.0	LSC	NA
Mg	5	ICP-AES	SW-846 6010B
Mn	0.005	ICP-AES	SW-846 6010B
Mo	0.003	ICP-MS	SW-846 6020
Ni	0.04	ICP-AES	SW-846 6010B
Np-237	0.1	AS	NA
NO_3-N	0.05	Colorimetric	EPA 353.2
PCBs	0.00025	GC	SW-846 8082
2,4-DNT	0.00003	HPLC	EPA 8330
2,6-DNT	0.00001	HPLC	EPA 8330
2,4,6-TNT	0.00003	HPLC	EPA 8330
1,3,5-TNB	0.00003	HPLC	EPA 8330
1,3-DNB	0.00009	HPLC	EPA 8330
Nitrobenzene	0.00003	HPLC	EPA 8330
Pesticides	0.00025	GC	8081A
PAH	0.005	HPLC	SW-846 8310
PO_4	0.5	IC	SW-846 9056
Po-210	1.0	AS	NA
Pu-238, Pu-239+Pu-240	0.1	AS	NA
K	5.0	ICP-AES	SW-846 6010B
Ra-226	1.0	RE	EPA 903.1, modified

Table 4−1 (continued). Typical DOE–LM Analyte List with Associated Analytical Specifications for a Water Matrix

Analyte[a]	Required Detection Limit (mg/L)[b]	Analytical Technique[c]	EPA Analytical Method
Ra-228	1.0	PC	SW-846 9320, modified
Se	0.0001	ICP-MS	SW-846 6020
Semivolatiles	0.01	GC-MS	SW-846 8270C
SiO_2	0.10	ICP-AES	SW-846 6010B
Ag	0.001	ICP-MS	SW-846 6020
Na	5.0	ICP-AES	SW-846 6010B
Sr	0.2	ICP-AES	SW-846 6010B
SO_4	1.0	IC	SW-846 9056
Sulfide	0.002	Titrimetry	EPA 376.1
Total organic carbon	0.3	IR	EPA 415.1
Tc-99	1.0	PC	NA
Tl	0.004	ICP-MS	SW-846 6020
Th-228, Th-230, Th-232	1	AS	NA
Sn	0.2	ICP-AES	SW-846 6010B
Total dissolved solids	10	Gravimetric	EPA 160.1
Total petroleum hydrocarbon	1.0	IR Spectrometry	EPA 418.1
Total suspended solids	5	Gravimetric	EPA 160.2
U	0.0001	ICP-MS	SW-846 6020
U-234, U-235, U-238	0.1	AS	NA
V	0.003	ICP-MS	SW-846 6020
VOCs	0.005	GC-MS	SW-846 8260B
Zn	0.02	ICP-AES	SW-846 6010B

[a]This table contains the majority of analyses conducted for LM ground water projects. Additional analyses may be required for future projects or other media.
[b]Units are in milligrams per liter (mg/L). Radiological detection limits are in units of picocuries per liter (pCi/L). The required detection limit is typically set an order of magnitude less than the standard.
[c]The primary technique is listed first. Laboratory technique acronyms and abbreviations are defined below.

AS	Alpha Spectrometry
COD	Chemical Oxygen Demand
CVAAS	Cold Vapor Atomic Absorption Spectroscopy
GC	Gas Chromatography
GC-MS	Gas Chromatograph - Mass Spectrometry
HPLC	High Performance Liquid Chromatography
IC	Ion Chromatography
ICP-AES	Inductively Coupled Plasma - Atomic Emission Spectrometry
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry
IR	Infrared
LSC	Liquid Scintillation Counting
NA	Not Applicable
PAH	Polynuclear Aromatic Hydrocarbons
PC	Proportional Counting
RE	Radon Emanation

End of current text

5.0 Quality Assurance

The Quality Assurance (QA) Program requirements and guidance documented in GA–3(P) "Standard Practice for Quality Assurance" (STO 6) should be used in implementing all environmental sampling and monitoring programs. This procedure addresses the requirements necessary for planning, implementing, documenting, and reviewing the activities, equipment, and records resulting from using this sampling and analysis plan. Additional QA requirements and guidance for LM Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites (i.e., Monticello, Fernald, Mound, and Rocky Flats) is contained in the *Legacy Management CERCLA Sites Quality Assurance Project Plan* (DOE 2006a).

5.1 Field Quality Assurance

Field quality assurance procedures include following the standard operating procedures discussed in this document and collection and analysis of QC samples. The types of QC samples collected include field duplicates, equipment blanks, and trip blanks. QC samples will be submitted to the laboratory under a fictitious identifier.

5.1.1 Field Duplicates

Duplicate water samples will be collected in the field on a frequency of one duplicate sample per 20 water samples for each analytical parameter. If less than 20 water samples are collected during a sampling event, one field duplicate will be required. Duplicate water samples will be collected by alternately filling the original and duplicate sample containers per analytical parameter. Frequency of duplicate samples for other matricies are specified in the site-specific procedure located behind the appropriate tabbed section in Appendix D.

5.1.2 Equipment Blanks

Equipment blanks provide a check for cross-contamination of samples from ineffective equipment decontamination. One equipment blank sample will be prepared in the field for every 20 water samples that are collected with non-dedicated equipment. If less than 20 (and at least one) samples are collected with non-dedicated equipment, then one equipment blank will be required. Equipment blanks will be prepared by collecting a sample of the final deionized rinse water (rinsate) used to decontaminate non-dedicated sampling equipment. Collection and frequency of equipment blanks for other matrices or filter blanks (air) are specified in the site-specific procedure located in Appendix D.

5.1.3 Trip Blanks

Trip blanks will be prepared using organic-free water obtained from a certified source and taken to the field by the sampling team. Trip blank samples will be prepared prior to the sampling trip when collection of water samples for volatile organic compound (VOC) analyses is required. Trip blanks subsequently will be handled as all other water samples collected for analysis of VOCs. Each ice chest in which VOC samples are stored or shipped will have an accompanying trip blank, which will be analyzed for VOCs only.

5.2 Data Qualification and Validation

Data obtained from ground water samples collected from Category II and Category III wells will be qualified with a "Q" flag indicating the data are qualitative due to sampling technique. This qualification will occur during the data validation process when "Q" flags will be entered into the SEEPro database. The "Q" flag will be displayed in the data validation column of the SEEPro database reports to provide notification to the data user. Data obtained from samples collected at Category I and Category IV wells are considered to be the highest quality, and qualification is not required.

Following a sampling event or period of ongoing monitoring, field and laboratory data will be validated and documented in summary reports. Data validation guidance is addressed in Appendix B.

5.3 Training

Personnel participating in sampling activities and the use of SOPs addressed in this plan will be proficient in the procedures for the work that they perform. Specific requirements for training, documentation, and associated tracking systems are found in the *Training Manual* (STO 4). An example of a form used to document training is shown in Figure 5−1.

5.4 Program Directives

Program Directives are used to document and authorize interim or site-specific changes to project documents. The procedures and format used for preparing Program Directives are found in Quality Assurance Instruction 1.5, "Program Directives" within the *Quality Assurance Manual* (STO 1). When needed, site-specific changes to this plan will be documented and approved through the use of a Program Directive. Program Directives that affect changes to this plan are prepared by the Environmental Monitoring/Field Services Lead and approved by the Site Task Order Manager. Program Directives will be managed as controlled documents and issued to all copyholders for inclusion in the appropriate tabbed section following the appendices to this plan. Guidelines, tracking logs, directive templates, and PDF files of approved directives are managed by the Environmental Monitoring/Field Services Lead on the 'condor' server, 'projects' share directory as follows: \LM\Overall Prog\SamplingProg\ProgDir.

5.5 Documentation

After the completion of a sampling event or period, the Sampling Lead will prepare a summary report that will document the specifics of the sampling event. Items that will be documented in the report may include

- Dates of the sampling event
- Team members
- Number of locations sampled
- Field variances
- Site disturbances
- Air sampler volume
- Air sampler flow rate
- QC samples
- Analytical report identification number(s)
- Equipment problems
- Required action items
- Well inspection summary
- Dates of deployment (TLDs, passive radon)
- Weight of particulates

Water Sampling Qualification Form

Completion of this form documents the training and qualification necessary to perform routine water sampling activities at the U.S. Department of Energy's Office of Legacy Management (DOE-LM) Sites.

Sampling and Analysis Plan Acknowledgement

I, _____, have read and understood the latest version of the Sampling and Analysis Plan entitled *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (May 2006, Rev. 0), which is used to guide routine water sampling activities at sites managed by DOE–LM.

_____ _____
Signature Date

Water Sampling Equipment/Procedures Proficiency

I certify that _____ has received on-the-job training in ground water and surface water monitoring at the _____ site. This person has demonstrated proficiency in: (1) the operation of specific monitoring equipment required for water sampling activities; and (2) the following specific procedures listed in the *Environmental Procedures Catalog*, which are required for routine water sampling activities:

GA-9(P),GT-1(P), GT-2(P), GT-3(P), GT-7(P), GT-8(P), LQ-1(G). LQ-2(T), LQ-3(P), LQ-4(T), LQ-5(T), LQ-6(T), LQ-7(T), LQ-8(T), LQ-9(T), LQ-10(P), LQ-11(P), LQ-12(P), LQ-18(P), and LQ-24(T).

_____ _____
Ground Water Monitoring Lead Date

_____ _____
Surface Water Monitoring Lead Date

Figure 5–1. Example Water Sampling Qualification and Proficiency Documentation Form

The Water Sampling Field Data form will be used at each water sampling location to record and document sample collection and identification, purge volume calculations, field measurement data, sampling equipment used, and instrument calibration information. The form will be completed following the protocol specified in procedure GT-1(P), "Standard Practice for Field Documentation Processes" (STO 6). Deviations from the procedures specified in this plan will be documented as a field variance on the Water Sampling Field Data form and, as appropriate, in the sampling summary report.

5.6 Records

Records associated with or generated through sampling activities include, but are not limited to:

- The *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*.
- Program Directives.
- Water Sampling Field Data form.
- Chain-of-Sample Custody forms.
- Sampling Summary Reports.
- Laboratory Analytical Data Reports.
- Field and Laboratory Data Validation Summary Reports.
- Air monitoring logs.
- Calibration logs.
- Soil sample collection logs and field maps.

6.0 Health and Safety

Sampling activities will be conducted according to the health and safety requirements specified in the *Health and Safety Manual* (STO 2). At some sites that have a higher complexity of site conditions (e.g., Tuba City, Arizona, Disposal Site), site access training will be specified in a formal site briefing. Task-specific health and safety requirements (including personal protective equipment needs) are addressed in Job Safety Analysis for sampling activities (Appendix C). Non-routine activities not specified in the Job Safety Analysis for sampling will be addressed in additional health and safety documents such as an additional Job Safety Analysis, Safe Work Permit, Radiological Work Permit, or Confined Space Evaluation.

End of current text

7.0 References

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Korte, N., 2001. *Application of Low-Flow Purging to the UMTRA Ground Water Project*, Grand Junction, Colorado.

Morrison Knudsen Corporation, 2001. *Environmental Compliance Department Instruction 29*, Revision 5, "Site Generated Waste Management for the Weldon Spring Site," Weldon Spring, Missouri.

STO 1. *Quality Assurance Manual*, (continuously updated), prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

STO 2. *Health and Safety Manual*, (continuously updated), prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

STO 4. *Training Manual*, (continuously updated), prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

STO 6. *Environmental Procedures Catalog*, (continuously updated), prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

Appendix A

Procedures Used for
Ground Water and Surface Water Sampling and Analysis

Appendix B

Data Validation Guidance

Appendix C

Job Safety Analysis

Appendix D

Site Specific Information and Program Directives

Current Index of Site Specific Program Directives as of March 2008

Directive No.	Effective Date	Expiration Date	Initiated By	Subject
CNT-2008-01	3/1/08	9/30/08	Sam Campbell	Miscellaneous Sampling Activities
FER-2008-01	9/30/07	10/01/08	Sam Campbell	Low-flow (micropurge) purging and sampling
FER-2008-02	9/30/07	10/01/08	Sam Campbell	Standard (high-flow) purging and sampling
FER-2008-03	9/30/07	10/01/08	Sam Campbell	Miscellaneous water sampling activities
FER-2008-04	9/30/07	10/1/08	Sam Campbell	Air monitoring activities
FER-2008-05	9/30/07	10/1/08	Sam Campbell	Parshall Flume Sampling, CAWWT Laboratory Operation
MND-2008-01	9/30/07	10/01/08	Sam Campbell	Ground Water Sampling
MND-2008-02	12/1/07	9/30/08	Sam Campbell	Air and NPDES Monitoring
RFS-2008-01	9/30/07	10/1/08	Sam Campbell	Miscellaneous sampling activities (VOCs, holding times, alkalinity and turbidity measurements.
RFS-2008-02	9/30/07	10/1/08	Sam Campbell	Purging and sampling of low producing wells
RFS-2008-03	9/30/07	10/1/08	Sam Campbell	Disposition of excess water **Note:** guideline attached (7 pgs)
RFS-2008-04	9/30/07	10/1/08	Sam Campbell	Processing of composite surface water samples **Note:** guideline attached (1 pg)
RUL-2007-01	08/13/07	09/30/08	Sam Campbell	Natural Gas Sampling
SHL-2008-01	3/1/08	9/30/08	Sam Campbell	Miscellaneous Sampling Activities

Ambrosia Lake, New Mexico
Bluewater, New Mexico
Burrell, Pennsylvania
Canonsburg, Pennsylvania
Central Nevada Test Area, Nevada
Durango, Colorado
Falls City, Texas
Fernald, Ohio
Gasbuggy, New Mexico
Gnome-Coach, New Mexico
Grand Junction Disposal Site
Grand Junction Office Facility
Grand Junction Processing Site
Green River, Utah
Gunnison, Colorado
Hallam, Nebraska
L-Bar, New Mexico
Lakeview, Oregon
Monticello, Utah
Monument Valley, Arizona
Mound, Ohio
Naturita, Colorado
Parkersburg, West Virginia
Rifle, Colorado
Rio Blanco, Colorado
Riverton, Wyoming
Rocky Flats, Colorado
Rulison, Colorado
Salmon, Mississippi
Sherwood, Washington
Shiprock, New Mexico
Shirley Basin South, Wyoming
Shoal, Nevada
Slick Rock, Colorado
Tuba City, Arizona
Weldon Spring, Missouri

Ambrosia Lake, New Mexico
Bluewater, New Mexico
Burrell, Pennsylvania
Canonsburg, Pennsylvania
Central Nevada Test Area, Nevada
Durango, Colorado
Falls City, Texas
Fernald, Ohio
Gasbuggy, New Mexico
Gnome-Coach, New Mexico
Grand Junction Disposal Site
Grand Junction Office Facility
Grand Junction Processing Site
Green River, Utah
Gunnison, Colorado
Hallam, Nebraska
L-Bar, New Mexico
Lakeview, Oregon
Monticello, Utah
Monument Valley, Arizona
Mound, Ohio
Naturita, Colorado
Parkersburg, West Virginia
Rifle, Colorado
Rio Blanco, Colorado
Riverton, Wyoming
Rocky Flats, Colorado
Rulison, Colorado
Salmon, Mississippi
Sherwood, Washington
Shiprock, New Mexico
Shirley Basin South, Wyoming
Shoal, Nevada
Slick Rock, Colorado
Tuba City, Arizona
Weldon Spring, Missouri